

| E.164 Single Number Table |                    |             |                    |                               |                      |                          |                       |                             |                             |                             |
|---------------------------|--------------------|-------------|--------------------|-------------------------------|----------------------|--------------------------|-----------------------|-----------------------------|-----------------------------|-----------------------------|
| E.164 Number Length       | E.164 Number Value | Number Type | Portability Status | Default / Exception Indicator | Transition Indicator | Extended Match Indicator | Extended Match Length | Service Control Data Slot-0 | Service Control Data Slot-1 | Service Control Data Slot-2 |
| 9                         | 851230001          | MSISDN      | ONPO               | Exception                     | Over                 | Exact                    | 0                     | SCDI-2                      | -                           | -                           |
| 9                         | 851230002          | MSISDN      | ONPO               | Exception                     | Not Over             | Exact                    | 0                     | SCDI-2                      | -                           | -                           |
| 9                         | 851230003          | MSISDN      | ONPO               | Exception                     | Over                 | Exact                    | 0                     | SCDI-3                      |                             |                             |
| 9                         | 851230004          | MSISDN      | ONPO               | Exception                     | Not Over             | Exact                    | 0                     | SCDI-3                      |                             |                             |
| 9                         | 861230001          | MSISDN      | FNPI               | Exception                     | Over                 | Exact                    | 0                     | SCDI-1                      | SCDI-4                      | -                           |
| 9                         | 861230002          | MSISDN      | FNPI               | Exception                     | Not Over             | Exact                    | 0                     | SCDI-1                      | SCDI-4                      | -                           |
| 9                         | 871230001          | MSISDN      | FNPI               | Exception                     | Over                 | Exact                    | 0                     | SCDI-1                      | SCDI-4                      | -                           |
| 9                         | 871230002          | MSISDN      | FNPI               | Exception                     | Not Over             | Exact                    | 0                     | SCDI-1                      | SCDI-4                      | -                           |
| 9                         | 861230003          | MSISDN      | FNP2AFN            | Exception                     | Over                 | Exact                    | 0                     | SCDI-3                      | -                           | -                           |
| 9                         | 861230004          | MSISDN      | FNP2AFN            | Exception                     | Not Over             | Exact                    | 0                     | SCDI-3                      | -                           | -                           |
| 9                         | 871230003          | MSISDN      | FNP2AFN            | Exception                     | Over                 | Exact                    | 0                     | SCDI-2                      | -                           | -                           |
| 9                         | 871230004          | MSISDN      | FNP2AFN            | Exception                     | Not Over             | Exact                    | 0                     | SCDI-2                      | -                           | -                           |

The acronyms for the Portability Status are as follows:

- ONNPO: Own Number Not Ported Out
- ONPO: Own Number Ported Out.
- FNPI: Foreign Number Ported In.
- FNP2AFN: Foreign Number Ported To Another Foreign Network.
- FNNK2BP: Foreign Number Not Known To Be Ported.

Table 1: E.164 Single Number Table for the Example.

| E.164 Range Number Table        |                                |                               |                              |             |                    |                               |                      |                    |                             |                             |                             |
|---------------------------------|--------------------------------|-------------------------------|------------------------------|-------------|--------------------|-------------------------------|----------------------|--------------------|-----------------------------|-----------------------------|-----------------------------|
| E.164 Number Start Range Length | E.164 Number Start Range Value | E.164 Number End Range Length | E.164 Number End Range Value | Number Type | Portability Status | Default / Exception Indicator | Transition Indicator | Single Number Flag | Service Control Data Slot-0 | Service Control Data Slot-1 | Service Control Data Slot-2 |
| 9                               | 850000000                      | 9                             | 859999999                    | MSISDN      | ONNPO              | Default                       | Over                 | Range              | SCDI-1                      | SCDI-4                      | -                           |
| 9                               | 860000000                      | 9                             | 869999999                    | MSISDN      | FNNK2BP            | Default                       | Over                 | Range              | SCDI-2                      | -                           | -                           |
| 9                               | 870000000                      | 9                             | 879999999                    | MSISDN      | FNNK2BP            | Default                       | Over                 | Range              | SCDI-3                      | -                           | -                           |

The acronyms for the Portability Status are as follows:

- ONNPO: Own Number Not Ported Out
- ONPO: Own Number Ported Out.
- FNPI: Foreign Number Ported In.
- FNP2AFN: Foreign Number Ported To Another Foreign Network.
- FNNK2BP: Foreign Number Not Known To Be Ported.

Table 2: E.164 Range Number Table for the Example.

| Service Control Data Table |                               |                           |                             |                            |                           |               |                |                 |            |            |
|----------------------------|-------------------------------|---------------------------|-----------------------------|----------------------------|---------------------------|---------------|----------------|-----------------|------------|------------|
| Service Control Data Id    | Service Control Data Function | Service Control Data Type | Service Control Data Length | Service Control Data Value | Address Info Present Mask | NoAI          | Numbering Plan | Cut Enable Mask | Cut Offset | Cut Length |
| SCDI-1                     | Insert                        | INRN                      | 5                           | 17685                      | Not Present               | NULL          | NULL           | Disabled        | NULL       | NULL       |
| SCDI-2                     | Insert                        | INRN                      | 5                           | 17686                      | Not Present               | NULL          | NULL           | Disabled        | NULL       | NULL       |
| SCDI-3                     | Insert                        | INRN                      | 5                           | 17687                      | Not Present               | NULL          | NULL           | Disabled        | NULL       | NULL       |
| SCDI-4                     | Replace                       | HLR-SCA                   | 12                          | 353857000420               | Present                   | International | E.164          | Disabled        | NULL       | NULL       |

Table 3: Service Control Data Table for the Example.

The Service Control Slots in the Single Number and Range Number tables are for a given configuration always filled with the same type of Service Control Data. This is illustrated for our example in Table 4.

| Service Control Slots Configuration Table |                           |                         |                      |
|---|---------------------------|-------------------------|----------------------|
| SAS Database Id                           | SAS Database Table Id     | Service Control Slot Id | Service Control Type |
| MNP E.164 Database 0                      | E.164 Single Number Table | 0                       | INRN                 |
| MNP E.164 Database 0                      | E.164 Single Number Table | 1                       | HLR-SCA              |
| MNP E.164 Database 0                      | E.164 Single Number Table | 2                       | -                    |
| MNP E.164 Database 0                      | E.164 Single Number Table | 3                       | -                    |
| MNP E.164 Database 0                      | E.164 Single Number Table | 4                       | -                    |
| MNP E.164 Database 0                      | E.164 Range Number Table  | 0                       | INRN                 |
| MNP E.164 Database 0                      | E.164 Range Number Table  | 1                       | HLR-SCA              |
| MNP E.164 Database 0                      | E.164 Range Number Table  | 2                       | -                    |
| MNP E.164 Database 0                      | E.164 Range Number Table  | 3                       | -                    |
| MNP E.164 Database 0                      | E.164 Range Number Table  | 4                       | -                    |

Table 4: Auxiliary Number Table for the Example.

### 2.1.2 Detection of Loops and other Inconsistencies

Loop detection is provided to prevent signalling loops within the signalling network. Signalling loops may occur when the routing databases in different signalling networks contain inconsistent routing information for network subscribers. The ability to detect signalling loops is defined within the scope of each SAS Application Service and may not be present in all SAS Application

| Loop Detection Status And Action Configuration Table  |                      |                           |             |                    |                                 |
|---|----------------------|---------------------------|-------------|--------------------|---------------------------------|
| SAS Application Service Id  | SAS Database Id      | SAS Database Table Id     | Number Type | Portability Status | Loop Detection State And Action |
| MNP-INAP-O-VM-IW  | MNP E.164 Database 0 | E.164 Single Number Table | MSISDN      | ONNPO              | Disabled                        |
| MNP-INAP-O-VM-IW  | MNP E.164 Database 0 | E.164 Single Number Table | MSISDN      | ONPO               | Discard, Counter                |
| MNP-INAP-O-VM-IW  | MNP E.164 Database 0 | E.164 Single Number Table | MSISDN      | FNPI               | Discard, Counter                |
| MNP-INAP-O-VM-IW  | MNP E.164 Database 0 | E.164 Single Number Table | MSISDN      | FNP2AFN            | Discard, Counter                |
| MNP-INAP-O-VM-IW  | MNP E.164 Database 0 | E.164 Single Number Table | MSISDN      | FNNK2BP            | Disabled                        |
| MNP-INAP-O-VM-IW  | MNP E.164 Database 0 | E.164 Range Number Table  | MSISDN      | ONNPO              | Discard, Counter                |
| MNP-INAP-O-VM-IW  | MNP E.164 Database 0 | E.164 Range Number Table  | MSISDN      | ONPO               | Disabled                        |
| MNP-INAP-O-VM-IW  | MNP E.164 Database 0 | E.164 Range Number Table  | MSISDN      | FNPI               | Disabled                        |
| MNP-INAP-O-VM-IW  | MNP E.164 Database 0 | E.164 Range Number Table  | MSISDN      | FNP2AFN            | Disabled                        |
| MNP-INAP-O-VM-IW  | MNP E.164 Database 0 | E.164 Range Number Table  | MSISDN      | FNNK2BP            | Discard, Counter                |
| The acronyms for the Portability Status are as follows:<br>• ONNPO: Own Number Not Ported Out<br>• ONPO: Own Number Ported Out.<br>• FNPI: Foreign Number Ported In.<br>• FNP2AFN: Foreign Number Ported To Another Foreign Network.<br>• FNNK2BP: Foreign Number Not Known To Be Ported. |                      |                           |             |                    |                                 |

Table 5: Loop Detection Status And Action Configuration Table for the Example.

### 2.1.2.2 Outline of SAS Application Service Specific Loop Detection Mechanisms

SAS Application Service Specific Loop Detection and detection of inconsistencies can be performed on the following principles (as soon as the principles are more precisely defined, respective configuration data items are introduced):

- If the network in which the A5070 SSE is located, can never be the transit network in a Number Portability scenario, then the received INRN must always be an own INRN:
- Reception of an INRN, which is not an own INRN, results in a detected loop.
- There has to be a configuration data item "Own INRNs", which specifies the list of the operator's own INRNs.
- Further checks on the received INRN are possible depending of other particular network conditions.
- Loop Detection is dependent on the Routing Principle in the network of the operator and in the portability domain:

| Table of Errors, Exceptions and Indications of the Database Search and the Generic Loop Detection Analysis |                                 |   |  |
|--|---------------------------------|---|--|
| Error / Exception / Indication Name  | Origin                          | Location where Error / Exception / Indication has to be handled | Comment  |
| Indication: "MATCH in Single Table."   | Database Search                 | SAS Application Service.  | Possible reactions of SAS Application Service: depending on configuration items: <ul style="list-style-type: none"> <li>Continue with Generic Loop Detection Analysis.</li> <li>Continue with Outbound Message Synthesis.</li> </ul>   |
| Indication: "AMBIGUOUS in Single Table"  | Database Search                 | SAS Application Service.  | Possible reactions of SAS Application Service: depending on configuration items: <ul style="list-style-type: none"> <li>Request more digits and start with the new string of digits again at Inbound Message Analysis.</li> <li>Interpret AMBIGUOUS as NO MATCH and continue with the respective behaviour.</li> </ul> |
| Indication: "NO MATCH in Single Table"   | Database Search                 | SAS Application Service.  | Possible reactions of SAS Application Service: depending on configuration items: <ul style="list-style-type: none"> <li>Continue with Range Number Table query.</li> <li>Continue with Outbound Message Synthesis.</li> </ul>  |
| Indication: "Error in Single Table"  | Database Search                 | SAS Application Service.  | Possible reactions of SAS Application Service: depending on configuration items: <ul style="list-style-type: none"> <li>Continue with Range Number Table query.</li> <li>Continue with Outbound Message Synthesis.</li> </ul>  |
| Indication: "MATCH in Range Table."  | Database Search                 | SAS Application Service.  | Possible reactions of SAS Application Service: depending on configuration items: <ul style="list-style-type: none"> <li>Continue with Generic Loop Detection Analysis.</li> <li>Continue with Outbound Message Synthesis.</li> </ul>   |
| Indication: "AMBIGUOUS in Range Table."  | Database Search                 | SAS Application Service.  | Possible reactions of SAS Application Service: depending on configuration items: <ul style="list-style-type: none"> <li>Request more digits and start with the new string of digits again at Inbound Message Analysis.</li> <li>Interpret AMBIGUOUS as NO MATCH and continue with the respective behaviour.</li> </ul> |
| Indication: "NO MATCH in Range Table."   | Database Search                 | SAS Application Service.  | Possible reactions of SAS Application Service: <ul style="list-style-type: none"> <li>Continue with Outbound Message Synthesis.</li> </ul>   |
| Indication: "Error in Range Table."  | Database Search                 | SAS Application Service.  | Possible reactions of SAS Application Service: <ul style="list-style-type: none"> <li>Continue with Outbound Message Synthesis.</li> </ul>   |
| Indication: "Signalling Loop Detected."  | Generic Loop Detection Analysis | SAS Application Service.  | Possible reactions of SAS Application Service: <ul style="list-style-type: none"> <li>Continue with configured Loop Detection Action.</li> </ul>   |
| Indication: "Signalling Loop Not Detected."  | Generic Loop Detection Analysis | SAS Application Service.  | Possible reactions of SAS Application Service: <ul style="list-style-type: none"> <li>Continue with Application Specific Loop Detection Analysis.</li> </ul>   |

Table 6: Table of Errors, Exceptions and Indications of the Database Search and the Generic Loop Detection Analysis

## 2.2 Outbound Message Synthesis

From all three stages, Outbound Message Synthesis is the one, which has the most application specific properties. However, there are configuration data items,

which occur for each SAS Application Service. In general, Outbound Message Synthesis takes the result of Stage 2 – Service Decision – and constructs the outbound response message. Figure 7 specifies the generic aspects of the Outbound Message Synthesis.

Configuration tables control Outbound Message Synthesis. The configuration tables of the Outbound Message Synthesis are illustrated by an example. The SAS Application Service is the same as the one used above: MNP-INAP With Optional Voice Mail Inter-working.

An Output Address includes the triple (NoAI, Numbering Plan, Digit String). The Output Digit String Configuration Table specifies the necessary output digit strings of the SAS Application Service, including a NoAI value. The value for Numbering Plan is implicitly present in the service logic of the SAS Application Service. Memory has to be allocated for the digit string elements of the Output Digit String Configuration Table, plus for Nat1 and Nat2 or Nat.

| Output Digit String Configuration Table |                        |                       |                             |                           |                           |
|---|------------------------|-----------------------|-----------------------------|---------------------------|---------------------------|
| SAS Application Service Id              | Output Digit String Id | Auxiliary Number Name | Nature of Address Indicator | Auxiliary Number Presence | Auxiliary Number Position |
| MNP-INAP-O-VM-IW                        | 1                      | INRN                  | Subscriber                  | Modified Input            | Prefix-0                  |
| MNP-INAP-O-VM-IW                        | 1                      | Nat1                  | Subscriber                  | Copy Input                | Nat1                      |
| MNP-INAP-O-VM-IW                        | 1                      | VMSC-INI              | Subscriber                  | Copy Input                | Infix-0                   |
| MNP-INAP-O-VM-IW                        | 1                      | Nat2                  | Subscriber                  | Copy Input                | Nat2                      |

Table 7: Definition of the Output Digit String Configuration Table for the Example.

| Output Digit String To Protocol Element Mapping Table |                        |                     |                            |
|---|------------------------|---------------------|----------------------------|
| SAS Application Service Id                            | Output Digit String Id | Protocol Element Id | Output Digit String Option |
| MNP-INAP-O-VM-IW                                      | 1                      | INAP Connect DRA    | 1                          |

Table 8: Output Digit String To Protocol Element Mapping Table for Table 7.

| Input Digit String To Output Digit String Mapping Table |                        |                       |
|---|------------------------|-----------------------|
| SAS Application Service Id                              | Output Digit String Id | Input Digit String Id |
| MNP-INAP-O-VM-IW  | 1                      | 1                     |
| MNP-INAP-O-VM-IW  | 1                      | 2                     |
| MNP-INAP-O-VM-IW  | 1                      | 3                     |
| MNP-INAP-O-VM-IW  | 1                      | 4                     |

Table 9: Output Digit String To Protocol Element Mapping Table for Table 7.

- The SAS Application Service Specific Outbound Processing Configuration Table for Normal and Abnormal Completion contains up to 10 Response Actions. One or more of these Response Actions can be used to insert configured values at defined positions in the output digit string.

| SAS Application Service Specific Outbound Processing Configuration Table – Normal Completion   |             |                    |                              |                              |                        |                             |
|--|-------------|--------------------|------------------------------|------------------------------|------------------------|-----------------------------|
| SAS Application Service Id   | Number Type | Portability Status | Response Action Id1          | Service Control Data Slot Id | Output Digit String Id | Nature of Address Indicator |
| MNP-INAP-O-VM-IW   | MSISDN      | ONNPO              | Send INAP Continue Operation | None.                        | None.                  | NULL                        |
| MNP-INAP-O-VM-IW   | MSISDN      | ONPO               | Send INAP Connect Operation  | 0 [INRN]                     | 1                      | Subscriber                  |
| MNP-INAP-O-VM-IW   | MSISDN      | FNPI               | Send INAP Connect Operation  | 0 [INRN]                     | 1                      | Subscriber                  |
| MNP-INAP-O-VM-IW   | MSISDN      | FNP2AFN            | Send INAP Connect Operation  | 0 [INRN]                     | 1                      | Subscriber                  |
| MNP-INAP-O-VM-IW   | MSISDN      | FNNK2BP            | Send INAP Connect Operation  | 0 [INRN]                     | 1                      | Subscriber                  |
| The acronyms for the Portability Status are as follows: <ul style="list-style-type: none"> <li>• ONNPO: Own Number Not Ported Out</li> <li>• ONPO: Own Number Ported Out.</li> <li>• FNPI: Foreign Number Ported In.</li> <li>• FNP2AFN: Foreign Number Ported To Another Foreign Network.</li> <li>• FNNK2BP: Foreign Number Not Known To Be Ported.</li> </ul> |             |                    |                              |                              |                        |                             |

Table 10: Definition of the SAS Application Service Specific Outbound Processing Configuration Table for the Example – Normal Completion.

| <b>SAS Application Service Specific Outbound Processing Configuration Table – Abnormal Completion</b> |   |                                  |                            |                               |                                    |
|---|---|----------------------------------|----------------------------|-------------------------------|------------------------------------|
| <b>SAS Application Service Id</b>   | <b>SAS Application Specific Abnormal Condition Id</b> | <b>Response Action Id1</b>       | <b>Response Action Id2</b> | <b>Output Digit String Id</b> | <b>Nature of Address Indicator</b> |
| MNP-INAP-O-VM-IW  | NO MATCH  | Send INAP Continue Operation     | None.                      | None.                         | NULL                               |
| MNP-INAP-O-VM-IW  | Error1  | Send INAP Release Call Operation | Release Call Cause n       | None.                         | NULL                               |

Table 11: Definition of the SAS Application Service Specific Outbound Processing Configuration Table for the Example – Abnormal Completion.

### 2.2.1 Generic Outbound Actions

This sub-chapter specifies Outbound Actions, which can be used by multiple SAS Application Services.

Each set of Outbound Actions is triggered by a value pair (Number Type, Portability Status) of the Single Number or Range Number tables.

#### 2.2.1.1 Digit Preparation in Outbound Digit String

The generic outbound action "Digit Preparation in Outbound Digit String" manipulates the output digit string or a part of it according to the specification in Table 18.

### 3. Configuration of Loop detection and outbound message synthesis

Configuration Items for Loop Detection:

There shall be a configuration data item "Perform INRN Based Generic Loop Detection" with the possible values YES and NO. Perform INRN Based Generic Loop Detection indicates whether or not the INRN Based Generic Loop Detection shall be used in the loop detection algorithm within the Service Decision phase of the respective SAS Application Service.

The received INRN might indicate a loop if it is not identical to the INRN found as a result of the query against the Single Number table and Range Number table.

There shall be a configuration table, which configures whether loop detection is enabled or disabled depending on each allowed value pair (E.164 Number Type, Portability Status) or (MSIN Number Type, Portability Status) of the respective single number or range number table. If Loop Detection is enabled, then an action has to be defined, which specifies what has to be done with the looping SS7 message.

| Loop Detection Status And Action Configuration Table |        |   |  |
|--|--------|---|--|
| Attribute  | Format | Values  | Description  |
| SAS Application Service Id                           | 2 Byte | Any valid SAS Application Service Id                  | Primary Key.   |
| SAS Database Id                                      | 2 Byte | Any valid SAS Database Id.                            | Primary Key.   |
| SAS Database Table Id                                | 2 Byte | Any valid SAS Database Table Id.                      | Primary Key.   |
| Number Type  | 1 Byte | Any valid encoding of Number Type                     | Primary Key.   |
| Portability Status                                   | 1 Byte | Any valid encoding of Portability Status              | Primary Key.   |
| Loop Detection State and Action                      | 1 Byte | Any valid encoding of Loop Detection State and Action | Possible values are "Disabled", "Enabled: Discard Message", etc. |

Table 12: Details of the Loop Detection Status Configuration Table

There shall be a configuration data item "Use Transition Time" with the possible values YES and NO. Use Transition Time indicates whether or not the Transition Indicator of the single number or range number tables shall be used in the loop detection algorithm within the Service Decision phase of the respective SAS Application Service.

The name of this configuration data item is SasDbTableUseTransitionTime. The syntax is:

SasDbTableUseTransitionTime = SasDbTableId, UseTransitionTime.

SasDbTableId is any SAS Database Table Id (details to be defined).

UseTransitionTime is an enumerated data type with values YES and NO.



| Output Digit String Configuration Table |        |   |  |
|---|--------|---|--|
| Attribute                               | Format | Values  | Description  |
| SAS Application Service Id              | 2 Byte | Any valid SAS Application Service Id  | Primary Key.   |
| Output Digit String Id                  | 3 Byte | Any valid Input Digit String Id   | Primary Key. SAS Application Service specific encoding. Multiple output digit strings per Protocol Element are possible. If multiple output digit strings are specified, then usage of each output digit string may be associated with a specific condition. It is a matter of the SAS Application Service how the association of a condition is mapped to a specific output digit string.   |
| Auxiliary Number Name                   | 1 Byte | Any valid encoding of Service Control Data Type.<br>E.g. SI, CC, INRN, OwnINRN, VMSC-INP, SMSC-INP, VMSC-INI, SMSC-INI, P, MCC, MNC, NC, GAC, EC, Nat1, NDC, Nat2, SN, BigCore, NotAllowed, Opaque.   | <p>Primary Key. An output digit string is defined by the explicit list of its Head parts, the BigCore and its Tail parts, identified by the respective names listed in the encoding of the common mnemonics encoding of the Service Control Data Type and the Auxiliary Number Name. It is possible in the Output Digit String, that any part from the Input Digit String can be explicitly manipulated by the service logic.</p> <p>The various types of Auxiliary Numbers and Core Part Numbers – identified by their Name – have the following structure (as far as known today):</p> <ul style="list-style-type: none"> <li>• CC: 1-3 hex digits.</li> <li>• All others have 1 or more hex digits, depending on the customer's network.</li> </ul> <p>A particular meaning has the following value:</p> <ul style="list-style-type: none"> <li>• NotAllowed: If an Auxiliary Number has this name, then the respective Output Digit String for a particular NoAI value is not allowed. The Auxiliary Number Presence is Always in this case, and the Auxiliary Number Position is Head-0. The Output Digit String must include this Auxiliary Item only.</li> <li>• Opaque: If an Auxiliary Number has this name, then the respective Output Digit String for a particular NoAI value will include a value derived from the Service Control Data Table as a replacement value. No structure of the Output Digit String needs to be known in this case. The Output Digit String must include this Auxiliary Item only, in position Head-0.</li> </ul> <p>The value "NotAllowed" is necessary, even in the combination with the Allowed Values of NoAI Configuration Table. Reason: there may be more than one option of output digit string for a given NoAI value, and in each option the allowed digit strings for a given NoAI value differ.</p> <p>Purpose of this parameter for the service logic of the SAS Application Service: This unique name is used to define each entity in the outbound digit string. The relationship between corresponding entities in the input digit string and the output digit string is defined on the basis of the Auxiliary Number Name.</p> |
| Global Title Indicator                  | 1 Byte | 00h: No Global Title (GT) included in address.<br>01h: GT in Address includes only NoAI.<br>02h: GT includes only TT.<br>03h: GT includes TT, NP, ES.<br>04h: GT includes TT, NP, ES, NoAI.<br>05-07h: Spare<br>International.<br>08-0Eh: Spare National.<br>0Fh: Reserved for extension.<br>10-13h: Internal Spare.<br>14h: GTI = 1 or 4.<br>15-22h: Internal Spare.<br>23h: GTI = 2 or 3.<br>24-FDh: Internal Spare.<br>FEh: Copy GTI from Input Digit String.<br>FFh: GTI is not used. | <p>This attribute is used in order to specify Input Digit Strings also dependent on the GTI, in addition to the dependence on the NoAI. In the SCCP Standard, the Global Title Indicator is represented as a 4 bit value. In this internal representation a 1 byte value is used in order to represent additional internal values:</p> <ul style="list-style-type: none"> <li>• 14h is used to specify that the actual receive GTI may either be 1 or 4. This makes sense as both have NoAI, and an operator may have chosen to define the same digit string structure for both values of GTI.</li> <li>• 23h is used to specify that the actual receive GTI may either be 2 or 3. This makes sense as both do not have NoAI, and an operator may have chosen to define the same digit string structure for both values of GTI.</li> <li>• FEh: GTI may also be used in the Output Digit String. This value specifies, that the GTI shall be copied from the corresponding Input Digit String.</li> <li>• FFh: The GTI is not used in all TCAP user addresses.</li> </ul>  |

|                             |        |   |  |
|-----------------------------|--------|---|--|
| Nature of Address Indicator | 1 Byte | Any valid protocol specific encoding of the Nature of Address Indicator.  | A NoAI value may be associated with a structure definition of an output digit string. NoAI in protocols has up to 7 bit for its encoding. Therefore, the value FFh is used as NULL value for this attribute, which means that no NoAI value is associated with this particular output digit string.  |
| Translation Type Control    | 1 Byte | Use, Do Not Use   | This attribute indicates whether or not the Translation Type shall be used in the specified Output Digit String.   |
| Translation Type            | 1 Byte | Any valid protocol specific encoding of the Translation Type  | A Translation Type value may be associated with a structure definition of an output digit string.  |
| Auxiliary Number Presence   | 1 Byte | Copy From Input, Modify Input With Service Control, Always as New Element From Service Control, Sometimes as New Element From Service Control, Always as New Element From Static Configuration. | <p>The presence of the auxiliary number. For the output digit string, the semantics is as follows:</p> <ul style="list-style-type: none"> <li>• Copy From Input: Copy from corresponding input digit string element. If the corresponding input digit string element was actually not present, this output digit string element is empty.</li> <li>• Modify Input With Service Control: Modification of the corresponding input digit string element. The modification is controlled by the respective Service Control Data item in combination with the pair (Number Type, Portability Status) of the found entry in the Single Number or Range Number table.</li> <li>• Always as New Element From Service Control: Always present as a new element, which was not yet present in the input digit string. The value is derived from the respective Service Control Data item, possibly in combination with the pair (Number Type, Portability Status) of the found entry in the Single Number or Range Number table. If an Auxiliary Number which is specified to be Always present as a new element, is not actually present, an error has to be reported.</li> <li>• Sometimes as New Element From Service Control: Sometimes present as a new element, which was not yet present in the input digit string. The value is derived from the respective Service Control Data item, possibly in combination with the pair (Number Type, Portability Status) of the found entry in the Single Number or Range Number table.</li> <li>• Always as New Element From Static Configuration: Always present as a new element, which was not yet present in the input digit string. The value is derived from static configuration data for this particular SAS Application Service.</li> </ul> <p>Purpose of this parameter for the service logic of the SAS Application Service: this attribute allows to generate an error, if an Always present optional digit string is not present in the output digit string.</p> |
| Auxiliary Number Position   | 1 Byte | Any valid encoding of Auxiliary Number Position.  | <p>Possible values are Head-0 to Prefix-31, and Tail-0 to Tail-31.</p> <p>Purpose of this parameter for the service logic of the SAS Application Service: specifies the correct position of this entity in the output digit strings.</p>   |

Note: An empty table for a given output digit string is not allowed, at least Opaque or something similar has to be specified.  
Note: A SAS Application Service accesses an Output Digit String by means of the following four key attributes: SAS Application Service Id, Protocol Element Id, Input Digit String Id, Nature of Address Indicator. The key attribute Auxiliary Number Name does not need to be used as it specifies the respective Auxiliary Numbers in the output digit string.  
Note: For each Input Digit String, which might be used in an Output Digit String, there has to be a dedicated definition of Output Digit String. It can be possible, that the one and the same structure of Output Digit String is defined for multiple Input Digit Strings.

Table 13: Details of the Output Digit String Configuration Table

| Input Digit String To Output Digit String Mapping Table                                    |        |                                      |  |
|--|--------|--------------------------------------|--|
| Attribute  | Format | Values                               | Description  |
| SAS Application Service Id   | 2 Byte | Any valid SAS Application Service Id | Primary Key.   |
| Output Digit String Id   | 3 Byte | Any valid Input Digit String Id      | Primary Key. SAS Application Service specific encoding. Multiple output digit strings per Protocol Element are possible. If multiple output digit strings are specified, then usage of each output digit string may be associated with a specific condition. It is a matter of the SAS Application Service how the association of a condition is mapped to a specific output digit string. |
| Input Digit String Id  | 3 Byte | Any valid Input Digit String Id      | Foreign Key to the Input Digit String from which this Output Digit String is provided with values. SAS Application Service specific encoding. Only one Input Digit String per Output Digit String is possible.   |
| Note: the relationship between Input Digit String and Output Digit String is many-to-many. |        |                                      |  |

Table 14: Details of the Input Digit String To Output Digit String Mapping Table

| Output Digit String To Protocol Element Mapping Table |        |                                      |  |
|---|--------|--------------------------------------|--|
| Attribute   | Format | Values                               | Description  |
| SAS Application Service Id                            | 2 Byte | Any valid SAS Application Service Id | Primary Key.   |
| Output Digit String Id                                | 3 Byte | Any valid Input Digit String Id      | Primary Key. SAS Application Service specific encoding. Multiple output digit strings per Protocol Element are possible. If multiple output digit strings are specified, then usage of each output digit string may be associated with a specific condition. It is a matter of the SAS Application Service how the association of a condition is mapped to a specific output digit string. |
| Protocol Element Id                                   | 3 Byte | Any valid Protocol Element Id        | SAS Application Service specific encoding. A protocol element is for instance a parameter of a service primitive. For a given protocol element one or more output digit strings are possible.  |
| Output Digit String Option                            | 1 Byte | Positive Integer                     | The sequence number of the Output Digit String Option. For each protocol element, it is possible to define multiple Output Digit Strings.  |

Table 15: Details of the Input Digit String To Protocol Element Mapping Table

A single output digit string shall be able to be selected – based on its Id - from a set of possible output digit strings. The selection is done based on the value combination of (E.164/MSIN Number Type, Portability Status). A table has to be present to specify this configuration data.

It shall be possible to specify which Service Control Slot (i.e. Service Control Data Sequence Number) of the found entry in the single number or range number table is to be used in the outbound processing depending on the value combination of (E.164 Number Type, Portability Status). A table has to be present to

| SAS Application Service Specific Outbound Processing Configuration Table – Normal Completion   |        |  |   |
|--|--------|--|---|
| Attribute  | Format | Values   | Description   |
| SAS Application Service Id   | 2 Byte | Any valid SAS Application Service Id                                     | Primary Key.  |
| Number Type  | 1 Byte | Any valid encoding of Number Type  | Primary Key.  |
| Portability Status   | 1 Byte | Any valid encoding of Portability Status                                 | Primary Key.  |
| Inbound NoAI Value   | 2 Byte | Any valid encoding of NoAI plus FFFFh for ignoring this attribute.       | Primary Key.<br>Some SAS Application Services need to take the NoAI value of the Inbound Address into account to determine the Outbound Action. The NoAI value to be used here is the one of this Inbound Address for which the database search in the Service Decision phase was done.<br>If this attribute is to be ignored during Outbound Processing, it has to be filled with FFFFh.                               |
| Response Action Id 1   | 3 Byte | Any valid Response Action  | Encoding is SAS Application Service specific. NULL value is FFh.  |
| Response Action Id 2   | 3 Byte | Any valid Response Action  | Encoding is SAS Application Service specific. NULL value is FFh.  |
| Response Action Id 3   | 3 Byte | Any valid Response Action  | Encoding is SAS Application Service specific. NULL value is FFh.  |
| Response Action Id 4   | 3 Byte | Any valid Response Action  | Encoding is SAS Application Service specific. NULL value is FFh.  |
| Response Action Id 5   | 3 Byte | Any valid Response Action  | Encoding is SAS Application Service specific. NULL value is FFh.  |
| Response Action Id 6   | 3 Byte | Any valid Response Action  | Encoding is SAS Application Service specific. NULL value is FFh.  |
| Response Action Id 7   | 3 Byte | Any valid Response Action  | Encoding is SAS Application Service specific. NULL value is FFh.  |
| Response Action Id 8   | 3 Byte | Any valid Response Action  | Encoding is SAS Application Service specific. NULL value is FFh.  |
| Response Action Id 9   | 3 Byte | Any valid Response Action  | Encoding is SAS Application Service specific. NULL value is FFh.  |
| Response Action Id 10  | 3 Byte | Any valid Response Action  | Encoding is SAS Application Service specific. NULL value is FFh.  |
| Service Control Data Slot Id   | 1 Byte | Any valid encoding of Service Control Data Slot Id                       |   |
| Output Digit String Id   | 3 Byte | Any valid Input Digit String Id  | Partial foreign key into the Structure of Output Digit String Configuration Table. SAS Application Service specific encoding. Multiple output digit strings per Protocol Element are possible.  |
| Nature of Address Indicator  | 1 Byte | Any valid protocol specific encoding of the Nature of Address Indicator. | Partial foreign key into the Structure of Output Digit String Configuration Table. NoAI in protocols has up to 7 bit for its encoding. Therefore, the value FFh is used as NULL value for this attribute. Per input digit string, the NoAI has to be considered. Therefore, per Input Digit String Id, multiple NoAIs are possible. For each NoAI of an Input Digit String Id, an input digit string has to be defined. |
| <p>Handling of NoAI values in the outbound processing: the NoAI value of the output digit string can be determined from the following four sources:</p> <ol style="list-style-type: none"> <li>1. The input digit string corresponding to the output digit string.</li> <li>2. The selected entry of the Service Control Data table.</li> <li>3. The output digit string, or</li> <li>4. The SAS Application Service Specific Outbound Processing Configuration Table – Normal Completion (this table).</li> </ol> <p>The NoAI in this table overrules the other three. If the NoAI value in this table is NULL, then the NoAI value of the selected output digit string has to be used. If the NoAI value of the selected output digit string is NULL, then the NoAI value of the selected entry of the Service Control Data Table has to be used. If this entry does not support a NoAI value, then NoAI value of the corresponding input digit string has to be used.</p> |        |  |   |

Table 16: Details of the SAS Application Service Specific Outbound Processing Configuration Table – Normal Completion

Table 16 Contains the application specific outbound processing in case an entry was found in the Single Number or Range Number Table. However, it is possible that no entry is found in both tables. This abnormal outbound processing is contained in Table 17.

| SAS Application Service Specific Outbound Processing Configuration Table – Abnormal Completion  |        |  |   |
|---|--------|--|---|
| Attribute   | Format | Values   | Description   |
| SAS Application Service Id  | 2 Byte | Any valid SAS Application Service Id                                     | Primary Key.  |
| SAS Application Specific Abnormal Condition Id  | 3 Byte | Any valid encoding of SAS Application Specific Abnormal Condition Id     | Primary Key.<br>Currently, the following possible values are defined:<br><ul style="list-style-type: none"> <li>Number Not Found: i.e. the extracted received number was not found the Single Number Table nor in the Range Number Table.</li> <li>SAS Database Error: this is any kind of SAS database error. The outbound handling in this case will similar to the one of Number Not Found. In addition an error report will be generated in order to trigger corrective action for the database.</li> </ul> |
| Response Action Id 1  | 3 Byte | Any valid Response Action  | Encoding is SAS Application Service specific. NULL value is FFh.  |
| Response Action Id 2  | 3 Byte | Any valid Response Action  | Encoding is SAS Application Service specific. NULL value is FFh.  |
| Response Action Id 3  | 3 Byte | Any valid Response Action  | Encoding is SAS Application Service specific. NULL value is FFh.  |
| Response Action Id 4  | 3 Byte | Any valid Response Action  | Encoding is SAS Application Service specific. NULL value is FFh.  |
| Response Action Id 5  | 3 Byte | Any valid Response Action  | Encoding is SAS Application Service specific. NULL value is FFh.  |
| Response Action Id 6  | 3 Byte | Any valid Response Action  | Encoding is SAS Application Service specific. NULL value is FFh.  |
| Response Action Id 7  | 3 Byte | Any valid Response Action  | Encoding is SAS Application Service specific. NULL value is FFh.  |
| Response Action Id 8  | 3 Byte | Any valid Response Action  | Encoding is SAS Application Service specific. NULL value is FFh.  |
| Response Action Id 9  | 3 Byte | Any valid Response Action  | Encoding is SAS Application Service specific. NULL value is FFh.  |
| Response Action Id 10   | 3 Byte | Any valid Response Action  | Encoding is SAS Application Service specific. NULL value is FFh.  |
| Output Digit String Id  | 3 Byte | Any valid Input Digit String Id  | Partial foreign key into the Structure of Output Digit String Configuration Table. SAS Application Service specific encoding. Multiple output digit strings per Protocol Element are possible.  |
| Nature of Address Indicator   | 1 Byte | Any valid protocol specific encoding of the Nature of Address Indicator. | Partial foreign key into the Structure of Output Digit String Configuration Table. NoAI in protocols has up to 7 bit for its encoding. Therefore, the value FFh is used as NULL value for this attribute. Per input digit string, the NoAI has to be considered. Therefore, per Input Digit String Id, multiple NoAIs are possible. For each NoAI of an Input Digit String Id, an input digit string has to be defined.   |
| <p>Handling of NoAI values in the outbound processing: the NoAI value of the output digit string can be determined from the following four sources:</p> <ol style="list-style-type: none"> <li>1. The input digit string corresponding to the output digit string,</li> <li>2. The selected entry of the Service Control Data table,</li> <li>3. The output digit string, or</li> <li>4. The SAS Application Service Specific Outbound Processing Configuration Table – Abnormal Completion (this table).</li> </ol> <p>The NoAI in this table overrules the other three. If the NoAI value in this table is NULL, then the NoAI value of the selected output digit string has to be used. If the NoAI value of the selected output digit string is NULL, then the NoAI value of the selected entry of the Service Control Data Table has to be used. If this entry does not support a NoAI value, then NoAI value of the corresponding input digit string has to be used.</p> <p>In general, the following kinds of response actions are obvious:</p> <ul style="list-style-type: none"> <li>• Return Message to Sender.</li> <li>• Return Error to Sender.</li> <li>• Forward Message to the Recipient to whom it would be routed without intervention of SAS.</li> <li>• Forward Message to configured Recipient.</li> <li>• Discard Message.</li> </ul> |        |  |   |

Table 17: Details of the SAS Application Service Specific Outbound Processing Configuration Table – Abnormal Completion

Table 18 contains the SAS Application Service Specific Outbound Digit String Preparation Configuration Table. This Configuration Table configures the generic Outbound Action "Digit Preparation in Outbound Digit String".

| SAS Application Service Specific Outbound Digit String Preparation Configuration Table |          |   |  |
|--|----------|---|--|
| Attribute  | Format   | Values  | Description  |
| SAS Application Service Id   | 2 Byte   | Any valid SAS Application Service Id  | Primary Key.   |
| Output Digit String Id   | 3 Byte   | Any valid Input Digit String Id   | Partial foreign key into the Structure of Output Digit String Configuration Table. SAS Application Service specific encoding. Multiple output digit strings per Protocol Element are possible.   |
| Output Digit String Component Id   | 1 Byte   | Any valid common encoding of Service Control Data Type and Auxiliary Number Name. | This attribute identifies the Output Digit String Element onto which the digit preparation applies. It is possible to specify here the complete Output Digit String by using the mnemonic "Total Digit String".  |
| Cut Position   | 1 Byte   | Positive Integer values 0-255.  | Effect:<br><ul style="list-style-type: none"> <li>0: The Digit Preparation is specified by means of the Cut Match Length/Value.</li> <li>1: Cut Position is before the 1<sup>st</sup> digit.</li> <li>2: Cut Position is before the 2<sup>nd</sup> digit.</li> <li>3: Cut Position is before the 3<sup>rd</sup> digit.</li> <li>n: Cut Position is before the n<sup>th</sup> digit.</li> </ul> |
| Cut Length   | 1 Byte   | Positive Integer values 0-255.  | Effect:<br><ul style="list-style-type: none"> <li>0: delete no digits after the Cut Position.</li> <li>1: delete 1 digit after the Cut Position.</li> <li>2: delete 2 digits after the Cut Position.</li> <li>3: delete 3 digits after the Cut Position.</li> <li>N: delete n digits after the Cut Position.</li> </ul>  |
| Cut Match Length   | ½ Byte   | Positive Integer values 0-15.   | Length in digits of the Cut Match Value. 0 means that there is no Cut Match Value.   |
| Cut Match Value  | 7 ½ Byte | Digit String with up 15 Digits.   | The Cut Match Value is a sequence of digits, which if found in search from left to right, shall be replaced by the Paste Value.  |
| Paste Length   | ½ Byte   | Positive Integer values 0-15.   | Length in digits of the Paste Value. 0 means that there is no Paste Value.   |
| Paste Value  | 7 ½ Byte | Digit String with up 15 Digits.   | Value which shall be inserted at the Cut Position, or which shall replace the Cut Match Value.   |

Table 18: Details of the SAS Application Service Specific Outbound Digit String Preparation Configuration Table